digital INTEROFFICE MEMORANDUM

TO: Educational Specialists
Sales Managers

DATE: 22 March 1972

FROM: Dave Ahl DHA

DEPT: Education Marketing

SUBJ: RSTS vs HP COMPETITIVE ANALYSIS

Attached is an exceedingly complete, comprehensive analysis of RSTS-11 versus the HP 2000 series. The natural inclination is to turn to the comparison of features at the end and get all puffed up because our features are better than theirs. DON'T DO IT!

Take an hour and read the entire comparison. Re-read it before calling on a RSTS prospect. This small investment of time will practically guarantee you a RSTS sale. If you depend upon the features chart alone, you probably will lose.

A RSTS configuration guide is in the works. Rather than delay this comparison, the configuration chart will follow in about 2-3 weeks.

The Education Products Group is indebted to Jim Bailey for the preparation of this comparative analysis. It's an outstanding document.

/ds

HP COMPETITIVE ANALYSIS

This is a memo about competing with the HP2000E and 2000F. It assumes that the customer has heard the RSTS story and heard the HP story and is now trying to decide which to buy. He's heard that HP is cheaper. He's heard that they have CAI. He's probably leaning a little HP. The time has come to blast them out of the water and close a nice, juicy RSTS order. Here's how to do it.

At the end of this memo is a reasonably detailed comparison of the HP timesharing systems and DEC's RSTS-11. Read it and understand it. If you like, spend a few minutes feeling all warm and happy about the fact that our BASIC is better than their BASIC. THEN BURN IT! Or at least file it way at the bottom of your bag. Because lesson #1 in selling against those systems is:

I. IF YOU SELL FEATURES AGAINST HP, YOU LOSE.

At first glance, this seems unbelievable. Our BASIC-PLUS is so overwhelmingly better than theirs that it seems like the natural thing to sell. Don't yield to this temptation. First, because both systems have a big long list of language features. So it's hard for the customer to really remember the decisive differences after you've gone away. Second, and most importantly, because the man from HP is going to spend more time with this customer than you are. He sells a 2000E the way you sell a DEC-system 10. And we all know that enough nose-to-nose time will wipe out a big discrepancy in system features. So if features is all you're standing on, HP's willingness to spend time and money up the gazoo is going to slowly but surely cut your legs off right at the knee-cap.

So should you really burn the features list? No, of course not. That's a little drastic. Just make sure you don't use it as your main tool against HP. Use it of course to point out that "anything they can do, we can do better." And use it hard where there's a requirement for a feature we have and they don't. But in general, forget features and go for the real jugular vein, which is obsolescence.

II. IF YOU BRING UP THE MATTER OF DEAD-END MACHINES, YOU START TO WIN

The most important job you have when selling against HP is to show the customer that the 2000E + 2000F are dead-end machines, maybe worse. REALLY PUSH THIS ONE. Both the 2000E and 2000F are based on the 2100 cpu, which is not HP's computer of the future. They've announced the totally incompatible System/3000 as their new machine. (Note: Chances are good that the HP salesman hasn't even mentioned the 3000, or if he has, has said that it's a new system being developed along with the 2100. It's our job to show that HP is developing the 3000 instead of the 2100.)

Chances are the customer doesn't appreciate the potential dangers of buying an obsolete machine. He sort of assumes that HP will continue at least its present level of support. Clue him in on the facts of life. System/3000 is totally incompatible with the 2100. Its hardware and software must be built up from scratch. They're just beginning. They're a small computer division that has always restricted itself to a single line of computers. The only way that HP can keep 2100 production lines going is to maintain sufficient sales volume on the cpu itself. But the 2100 is getting its ass whipped in the OEM markets that are the only ones that can provide that volume. So where, dear friends, does that leave the 2100? Who's to say it won't go completely out of production next year? Leaving present owners high and dry?

HP will protest vigorously that they will stand by the 2100. But all indicators are that it is not in their interests to continue to develop it. And there are strong indicators coming out of HP that they seriously underestimated the 3000 project. Who knows but that they may have to shut down the 2100 just to try to keep the 3000 afloat.....

In any case, we can be sure that continued 2100 support will be done by HP's least capable, least experienced people. Assuming the customer can still get service two years from now, it will undoubtedly be the office green-horn he will see, or someone trained only on the 3000.

There are two issues at work here. First is the fact that the customer is going to have a harder time getting good service as HP phases over to the 3000. It will be harder to get parts and harder to get experienced 2100 servicemen. This will make the system harder and harder to live with as the years go by. Second, and much more important, is the stigma of buying an obsolete machine. Nobody wants to be fingered as buying an obsolete computer, especially when it was obvious at the time he bought it that it was obsolete.

Just how much HP will support the 2100 in the future is hard to say. It is doubtful that they will drop it to the point of refusing to offer service contracts on it. But it is just as doubtful that they will continue to support it with as many sales and service people as they have. Support will probably continue, but diminish. But even if it were to continue, the 2100 is still a dead-end, obsolete mini-computer. It cannot be expanded to a 3000 because the 3000 is hardware and software incompatible. He's stuck with a mini-computer system forever.

Needless to say, DEC has a much better story to tell. PDP-11 is clearly DEC's machine of the 70's. It is just as clearly the world's machine of the 70's. Market acceptance of the 11/45 is overwhelmingly good. So the customer need not worry about support - it is increasing. He need not worry about looking stupid - he's buying the machine of the 70's. And best of all, he need not worry about expansion. Unlike HP, DEC built its medium-scale computer (11/45) to be totally compatible with the smaller 11's. The RSTS buyer is not limited to a small computer system for the rest of his life.

In short, buy a 2100 system today and things can only get worse. Buy a PDP-11 system and things can only get better. It's a nice argument, _especially_ in a school. Schools tend to look a long way out. That computer is going to have to last five, maybe 10 years. They may get money to expand during that time, but they probably won't be able to justify throwing this computer away and getting a bigger new one.

Push the guy a bit on this one. Suppose his needs increase. (They're bound to.) He can reasonably ask for funds to expand his machine to meet these needs. But dare he ask for money to buy a whole new 3000 system 3 or 4 years from now? With HP, all he can do is add more terminals to an already overloaded minicomputer (more on this later.) With DEC, he has a variety of future options, including upgrading his 11/20 cpu to an 11/45 without having to replace the whole system. And all the future software being built by DEC for the 11/45 will be available to him (None of which is announced yet, but you can allude to the fact that the 11/45 will in the future support operating systems at least as powerful as the HP3000.) So, Mr. Customer, looking ahead to 1975, which looks like the more reasonable choice, 2100 or PDP-11? Now we're getting somewhere.

III. WHEN YOU GO ON TO COMPARE "BIG-JOB" VERSUS "SMALL-JOB" TIME-SHARING SYSTEMS, YOU PUT HP ON THE DEFENSIVE

So far we've been dwelling on the fact that buying a 2000E or F is a risky business in view of the shaky future of the 2100. This is the kind of argument that will stay with the guy long after you leave, so take the time to fully develop it. (If you're really feeling your oats, you might even lapse into speculation about what will happen if the HP3000 runs into costly delays, which seems likely. HP is a pretty big company that does not depend on its struggling computer division for survival. The last computer company to be in that position was RCA....) But we also want to point out that HP's limitations are not limited to the future. There are good reasons to believe that HP's systems won't even do the customer's job today. _They are basically small job systems_.

OK, what is a small-job system? It's a system that's optimized to run small, simple tasks rather than big ones. It is designed for jobs that run a few minutes, not a few hours. It is designed for data files with a few hundred records, not thousands. And its designed for small amounts of output, not lots.

In fact, most of the users of a time-sharing system will have small jobs to run. If the customer is a school, for example, most of the student jobs will be small. But not all of them will! This is the key point. The system must be able to handle big jobs as well as little jobs. Complex simulations. Data processing. Advanced student work. Normally, you won't have any trouble getting the customer to agree that he will be doing quite a bit of sophisticated stuff, with more to come in the future. (Nobody admits that they're only going to do simple stuff.) Now let's see what the problems are with HP.

First, there's the hardware. The 2100 is probably a reasonable machine for 16 users. But not for 32. And adding the second 2100 doesn't help the big jobs at all. It is used solely for terminal I/O. The whole computing load, the editting and running of all programs, is still piled on one 2100. Since the basic computer power remains the same and the number of users double the power per user goes down by half! So the amount of big-job computing power actually goes down in the bigger system. Is this what the customer had in mind for his expansion?

Don't push this one too hard. Just get the guy thinking about it. If he takes a program that takes 10 minutes to run as the only job on a 2000E, it will still take 10 minutes to run on the 2000F. But with the F, there are 31 other users competing for that poor little processor, not just 15.

HP will come back with its floating point processor as the thing that lets it handle lots of users. This is a problem on the 16 user system where they have it, but we don't. Use the 11/45 floating point to combat this. It's about 10 times the speed of HP's. You might make some comment like "Look, if you want floating point, get a real one, not a toy..." Then get on to something else. Don't get bogged down in the features comparison!

The real weakness that limits HP to small-job status is its primitive I/O, specifically its lack of assignable devices. Start with mag-tape. If the guy is planning to get it, use the following argument directly. If he's not, point it out as an example of HP's small-job design thinking. (And to give him a preview of the problems he'll have when he adds it later on.)

To use magtape on the HP3000, you have to run a combination on-line, off-line system. The systems are not designed to run continuously. You start the system up, time-share a while, take it down, then back up, then down, and so on, all day long. Specifically, every time anyone wants to load a program from magtape, or even store a program on magtape, you have to take the system down, run a stand-slone program, then bring the system back up. If you're still feeling your oats, you might allude to the HP system's very complete set of commands for taking the system down and bringing it back. (The 2000F even has a command to log off all users. How's that for power. 32 users with the rug pulled out from them, 32 programs lost, all simultaneously with a single keyboard command. That's true timesharing folks!) The reason they have all these nice commands, you continue in your straightest of straight DEC faces, is that you'll be doing it all day long.

Before going on, inquire as to whether the HP representative made it clear that the 2000E and 2000F are combination on-line, off-line systems. The brochures certainly don't go out of their way to make this clear. They list on-line and off-line commands together. You have to check the foot-notes to learn the truth. If the salesman didn't make this point clear, you of course do it for him. And send his credibility for a ride.

Here again, don't get bogged down in features. Stress the day-to-day operational problems the HP system entails. First, ask how many times the customer plans to use the tape unit each day. He'll probably say "once in the morning and once at night." Ask if he can really justify the cost of the tape unit on the basis of twice-a-day operation. What's he going to say when his boss wants to see why the tape unit was so necessary? Furthermore, who's going to do the loads and dumps? Users cannot be allowed to take the system down. The system manager will have to do it, twice a day every day at least. And who's the system manager? Invariably, it's the customer himself. This is the fact that we want to focus the customer's eyes on: that HP tape unit is going to be responsible for all the morning and evening dumps. And what about the important professor who forgot to get his data loaded, but needs it that day. (Or worse still, the registrar.) Who's he going to come to demanding that the system be taken down so his stuff can be loaded? If the system manager does it, he gets angry letters from all the users he screwed. If he doesn't, he has an important colleague on his neck. Is that what the customer really wants?

DEC, of course, has a better story. All peripheral devices are always available, all day long. Hence they get maximum utilization and clearly justify their cost. Since they're always available, it's never necessary to take the system down, thereby disturbing on-line users. But most important, it's self-service, or done by an operator. The user handles his own; the system manager doesn't have to get involved.

This whole argument can get a bit complex, but there's no need to force-feed it. The key thing is that, with HP, there is an inherent conflict between those who want to load their programs and those who want to run them. This is bad enough because any good system lets both go on at the same time and hence is more efficient. But the real problem with this conflict is that, inevitably, the system manager is going to get caught in the middle. Does he really want to suffer all that grief?

Of course, some customers will minimize the importance of loading and dumping on magnetic tape. But this says that they are limiting their system to programs and data so small that they can be put on paper tape. (i.e. they do want a small job system after all. And if that's the case, DEC has just the system for them; a PDP-8 based EduSystem.)

IV. IF YOU TIE THESE ARGUMENTS TOGETHER WELL, YOU'RE READY TO MAKE THE KILL

The goal of all this is simple: to undermine the customer's confidence in HP. We want to show that HP is not a reasonable choice for him to make:

1) It's unreasonable because there's a real possibility of decreased HP support for the 2100.

2) It's unreasonable because it leaves him wide open to ridicule for having bought an obsolete machine.

3) It's unreasonable because there's no meaningful expansion except to add more terminals to an already overtaxed mini-computer.

4) It's unreasonable becuase it means a lot of operational pains-in-the-neck for him.

In short, any customer who buys a 2000E or 2000F is sticking his neck out a long way. Now, of course, we go to the attack. We point out that not only is he sticking his neck out, he's sticking his neck out unnecessarily, because there's a much more reasonable alternative: RSTS-11.

1) It's clearly the machine of the 70's. Hardware, software, and peripheral support is growing, not shrinking. So is service.

2) No one can fault him for buying a PDP-11. It's the machine of the future and has wide market acceptance.

3) It has no annoying operational aspects that will plague the system manager.

V. NOW, AND ONLY NOW, DO WE SELL THE FEATURES

Only after we've undermined the basic reasonableness of going HP do we start to sing the praises of RSTS in particular. Not only is DEC the safer, more reasonable, choice, its really the best timesharing system as well. It runs a better version of BASIC and gives free access to all peripheral devices. This, dear friends, is the best of both worlds.

The attached chart gives a feature-by-feature comparison, that shows how we stack up. But give the following features your most extra special attention:

Sharable Devices: We've already pushed this one, but for God's sake keep hammering at it. We're two steps ahead here. Not only can we do it without taking the system down, we can access any device from a BASIC program. This means that a BASIC program can read and write a data file stored, for example, on a DECtape or magtape. The file is mounted only as long as its needed and there's never the need to move the whole file to disk. Sensitive data files (like student or personnel files) can be dismounted and locked. Users can keep their programs on their own tapes. And RSTS' record I/O allows the reading and writing of magtapes in a format readable on another machine. HP isn't even in this ballgame. While their system is timesharing, all of their devices are useless except the line printer. (One way to get this across is to draw a picture of their system. Put the terminals and the line printer on one side. Then put the paper tape reader, the magtapes, and disk cartridges on the other. Disk cartridges go here because you have to take the system down to change cartridges. Label one side "System 1." Label the other "System 2." Then draw a great big switch, to emphasize that you get one or the other. When you use the terminals, you don't use the tapes. When you use the tapes, you don't use the terminals. So no matter what you do, you waste a large part of your investment. Then draw RSTS, where everything goes on the same side as the terminals. Nothing is ever wasted.)

Print Formatting: There is a big weakness of standard BASIC, where there's no simple way to even line up the decimal points in a column of figures. For example, the 2000E has only this crude kind of formatting, but even it cannot match RSTS. The place where we excell is the kind of formatting that edp requires: floating dollar sign, asterisk protect, and trailing minus sign. Most customers would like to do some edp report generation on their system. RSTS is set up to do it (Note: don't push this one unless the customer does have a requirement.)

Other Features: Check the features comparison chart for other goodies to sell on. But remember that HP can at least come back on many of them (i.e. their system cannot do it as neatly, but it can do it). What we want to avoid is having the customer take 20 features and end up saying, well DEC has all 20 but HP can do at least 15, although not as fancily. We want the score to be 5 to 0, not 20 to 15.

VI. AND FINALLY, WE COUNTER THE HP ARGUMENTS

What follows is a summary of the features stressed in the 2000E and 2000F brochures. Keep in mind that the 2000F has many features not available on the 2000E. Here again, the HP salesman probably fails to make this clear. If the customer asks "Do you have print formatting?", the HP salesman will undoubtedly say yes, because the 2000F has it. But in all probability, the customer will start out with a 2000E. So the first step in countering HP sales claims is to make sure the feature exists on the system the customer is actually going to buy.

2000E Selling Features

a. Lots of ID codes. The 2000E has 768, the 2000F has 3072. (RSTS allows 1735.) Respond by pointing out that the more ID codes, the more administrative headaches. Most installations want accounting information daily. Does he realize that 3000 ID's means a 90 minute accounting printout every day? (As near as we can tell from the HP manual, there's no way to get accounting information for selected users. It's all or nothing, baby.) In short, lots of account numbers is going to mean lots of accounting headaches for the person in charge of the system (i.e. him.) For these reasons, most installations use only 50-100 ID's.

b. Very simple system activation and deactivation. Don't deny this. Instead, suggest that it's so well implemented because he, the customer, is going to be doing it all day long.

c. Magnetic tape file storage. As we've already said, climb all over this one! You have to take the system down every time you do it!

d. Floating Point Hardware. A winner that we don't have a good response for at the 16 user level. Point out that our 16 user system has EAE, although not full floating point. Best bet is to use the 11/45 fpp to discredit the HP fpp. Their's is cheap, but our's is 10 times as fast. If you can, point their fpp as a quaint little toy. But remember that they have it and we don't (except on the 11/45 systems) so best bet is to cool it and get the conversation somewhere else. HP will score points on this one no matter what we do.

e. Separation of Programs on Specific Disks. This one is a bit vague. Their idea is that groups of users can have their programs on the same disk cartridge, making it easier to change cartridges. Our response is "Beautiful, but you have to take the system down every time you change a disk cartridge!" RSTS allows user cartridges to be mounted and dismounted on-line. I don't expect HP to really push this since RSTS has a much better story.

f. Multi-speed ports. They can support 10, 15 and 30 cps ports. So can RSTS. If they bring this up, don't just say "So can we." Score some points by asking what 15 and 30 c.p.s. terminals HP is supplying and how much they cost. As far as we now know, HP can only offer tty's and Data-point 3300's (our old VT06's). Our DECwriters and VT05's are better and cheaper. We can embarrass HP here by pointing out that they offer 30 c.p.s. ports, but where are the terminals. They're either nonexistent (30 cps hard copy) or too costly (Datapoint).

g. Priority Scheduler. This seems a detail and maybe the best response is "So what?" I doubt it will come up. And if the user is sophisticated enough to understand schedulers, he should be leaning RSTS anyhow.

h. Accounting System. HP has a nice simple accounting system. But RSTS has everything they do, so I doubt it will be an issue. If it is, point out that the HP system is limited to a raw typeout of data. On RSTS, accounting information can be read and manipulated by a BASIC program, even to the point of printing out weekly bills and doing it on the line printer to boot! But for the most part, this will be a we have it, you have it sort of thing.

i. Library System. They have a protected public library for everyone and a private library for each user. So do we. But point out that programs cannot be shared among a subset of users as they can on RSTS. A program is either available to a single user or available to everyone. HP will score some points on the fact that they offer 100 applications programs (count 'em, 100). Counter with the Education Software Package. Stress the fact that DEC doesn't just hand out raw programs; it provides comprehensive and integrated curriculum materials and detailed guides to actual classroom use. (You may want to practice this line ahead of time to make sure you don't gag on it.)

j. Other Operating Modes. HP pushes their DOS and realtime operating systems. If the customer really requires this kind of stuff, he's probably reasonably sophisticated and we should be able to turn him on to time-sharing. Most customers really want timesharing, though, and see this as a bonus. Climb all over this, however, by repeating the argument that HP pushes it off-line capabilities so hard because their on-line capabilities are so weak. You have to use one of these off-line systems to even get a file from magtape. Oh, and by the way, DEC also has DOS and a realtime system. But our timesharing system already includes complete file handling, so we don't make as big a thing of it.

k. Standard Dartmouth BASIC is a subset of HP BASIC. Us too.

l. Matrix commands. We have every matrix command they have. Note that they are limited to 2500 matrix elements per program. Jump on this. RSTS' unique "virtual arrays" allow program matrices to be essentially unlimited in size! (limited only by disk space) So we have big arrays, they don't.

m. String Manipulation. Again, we have everything they have PLUS. Their string are limited to 72 characters. Ours are unlimited in size. We have special functions to search for substrings within strings. They don't. We can have arrays of strings. They can't. In short, our string capability is clearly superior.

n. Data files. Once again, we have everything they have, PLUS. They can only have four files open, we can have 12. Their files must be on disk, ours can be on disk, DECtape, or magtape. Their files are limited to 6k words in size, which is a joke. Ours can be as big as the device they're on, i.e. 1.2 million words on a RK03. They allow several users to simultaneously access a disk file. So do we. Again, in short, our file capability is clearly superior to theirs.

o. Program Chaining. Concede a few points to HP here because of their common storage which allows data to be passed from one program segment to another without being put in a disk file. This is better than RSTS, which uses disk files for this purpose. (However, note that RSTS does have a 124 byte core common area, so in a simple spec. type situation, we do have COMMON, albeit weakly.) You might point out that, while HP gains some chaining efficiency by COMMON, they lose a lot because program segments cannot be stored in compiled form. They have to set up each segment as it is called. RSTS allows program segments to be stored in their compiled format. (Note that HP concedes this point. The 2000F has the ability to store semi-compiled code. As they themselves say in the 2000F brochure "Semi-compiled code allows faster program execution, particularly where many programs are chained together.")

p. System clock. Us too.

q. Diagnostics. Us too.

r. Compatibility. The 2000E is mostly compatible with the B, and C. This is only an issue if the user has worked on a 2000 machine before. If he has, you might turn the argument around by saying that compatibility really means that all the restrictions of the 2000A have been retained on the 2000E. Does the customer really want to be locked into a 1968 vintage design? Isn't it about time to latch onto some really modern features and a really modern BASIC?

2000F Selling Features

a. Lots of ID codes (3000 of 'em).

b. Simple system activation and deactivation.

c. Magnetic tape file storage.

These are all the same as the 2000E. Use the same counterarguments. Stress the uselessness of their off-line tape storage.

d. Floating Point Hardware. Unlike the 16 user system, there's no need to be at all defensive here. The 11/45 fpp is 10 times the speed of HP's toy fpp.

e. Storage of compiled programs. Us too.

f. On-line printer. Excellent feature! That's why we offer it, too, along with on-line card reader, on-line magtape, on-line DECtape, on-line paper tape reader, on-line paper tape punch. Use the fact that they have an on-line printer to emphasize that fact that everything else isn't.

g. Self-diagnosis of hardware. This says that if a non-critical component fails, it can be taken off-line without taking the system down. Our question is, what components are non-critical? Our bet is that everything but the line printer, magtapes, paper tape reader, and possibly the disk packs are critical. But the magtapes and paper tape are unusable anyway. And I'll bet that the first two disk packs or cartridges are critical as well. So on the standard 2000F, every usable component is critical. I doubt that this will come up, but if it does, have the customer ask HP which parts of his system are non-critical. If it's still an issue, call Maynard for help.

h. Communications Processor. HP says their system is more powerful because of a second processor. But what does it do? Terminals and line printer. The entire processing, swapping, and file load for all 32 users still rests on a single 2100. Don't let HP get away with any "dual processor" talk!

i. Multi-speed Terminals. HP offers a really impressive variety of terminal speeds. But remind the customer that they're worthless unless he has the terminals to go with them. What terminals can HP offer him with the system and what do they cost? Point out that DEC has 10 c.p.s. hard copy (tty) 30 c.p.s. hard copy (LA30) and 10-240 c.p.s. CRT (VT05), and at prices the customer can afford. And supported and serviced by DEC. Don't let the customer evaluate port speeds independent of actual terminals.

j. Library System. The 2000F has a three level file system (individuals, groups, and all users.) So does RSTS. But RSTS also allows single users to have private packs for protected storage.

k. Other operating modes. See 2000E section.

l. BASIC language. The 2000F comes closer to RSTS by adding bigger strings (up to 126 chars), big files, 16 open files, and PRINT USING. But they still don't have any resource sharing.

m. Large Program Size. The 2000F allows 1000 line programs compared to about 350 for RSTS. HP will push this. Respond by pointing out that data size is usually much more important than program size. RSTS' unlimited array size is more important than big program size. (As an aside, you might point out that, in practice, 1000 line capacity in BASIC is useless. Variable names in the BASIC language are limited to a single letter and a single digit. Challenge the customer to write and debug a 1000 line program without tripping all over his variable names.) Also note that RSTS allows multiple statements per line for big program capacity. (One present RSTS customer has even written a program to take a program written one statement per line and pack it into multiple statements per line. This program was written in BASIC-PLUS.)

n. Data scrambler. This is a curious little feature that scrambles data files so that other programs cannot decipher them. DEC agrees that data file integrity is important. That's why we have DECtape and magtape files so the file can be removed and put under lock and key. If the customer really wants security, that's what he needs. Not some data scrambler that will just challenge his students to stay up all night till they break the code. (If the customer brings the data scrambler feature up, you might wonder out loud whether HP trusts their file protection scheme.)

VII. CONCLUSION

In short, HP has a nice system but we have a much nicer one. The floating point hardware on the 16 user system is the only thing we cannot counter vigorously. There are a few other things that we counter a bit lamely, but the key point is that for the majority of the features that HP themselves are pushing, we're not only equal, we're clearly better. And they have no response at all to our resource sharing. By themselves, these are strong selling arguments that allow us to be on the offensive whenever we face HP. When heaped atop the very serious questions of obsolescence and uncertain future support, these are the things that will close the sale. So don't just sit there. Go close the sale!

	USERS			32 USERS		
FEATURE	RSTS-20	WINNER	HP 2000 E	RSTS-45	WINNER	HP 2000 F
I. PROGRAM + DATA SIZE						
Maximum Program Size - No Data	350 lines		350 lines	350 lines	→	1000 lines
Program Chaining	YES		YES	YES		YES
Compiled segments	YES	←	No	YES		YES
Data passing between segments	Disk Files	→	Files or COMMON	Disk Files	→	Files or COMMON
Maximum Data Size: # 50 x 50 arrays	50	←	1	50	←	2
Maximum Program Size - Maximum Data	350 lines	←	2 lines	350 lines	←	6 lines
II. SIMPLE LANGUAGE CAPABILITIES						
Standard basic BASIC (REM, LET, DIM, RANDOM, IF, FOR, NEXT, GOTO, GOSUB, RETURN, READ, DATA, RESTORE, PRINT, INPUT, STOP, END)	YES		YES	YES		YES
Standard BASIC Functions (ABS, ATN, COS, EXP, INT, LOG, RND, SGN, SIN, SQR, TAN, TAB)	YES		YES	YES		YES
Standard Operators (+, -, *, /, ↑, =, >, <, >=, <=, < >)	YES		YES	YES		YES

	16 USERS			32 USERS		
FEATURE	RSTS-20	W-I-N-N-E-R	HP 2000 E	RSTS-45	W-I-N-N-E-R	HP 2000 F
III. MATRIX CAPABILITIES						
Matrix Statements (READ, PRINT, INPUT)	YES		YES	YES		YES
Matrix Functions (TRN, INV)	YES (plus DETerminant)	←	YES	YES (plus DETerminant)	←	YES
Matrix Initialization (ZER, CON, IDN)	YES		YES	YES		YES
Matrix Operators +, -, *, scalar *, =	YES		YES	YES		YES
Unlimited Array Size	YES	←	NO	YES	←	NO
Compact Storage of Integer Arrays	YES (1 word per value)	←	NO (2 words per value)	YES (1 word per value)	←	NO (2 words per value)
Integer subscript arithmetic (for faster array calculations)	YES	←	NO	YES	←	NO

FEATURE	16 USERS			32 USERS		
	RSTS-20	WIN	HP 2000 E	RSTS-45	WIN	HP 2000 F
IV. STRING CAPABILITY						
Maximum size of single string	unlimited	←	72 characters	unlimited	←	126 characters
Standard String Operations (INPUT, PRINT, READ, compare, Assignment)	YES		YES	YES		YES
Standard String Functions (LEN, CHR$, DATE$, TIME$)	YES		YES	YES		YES
Substring Parsing and Search Functions	LEFT, RIGHT, MID, INSTR	←	none	LEFT, RIGHT, MID, INSTR	←	none
String to Value Conversion Functions	ASCII, NUMS, VAL	←	none	ASCII, NUMS, VAL	←	none
String Arrays	YES	←	NO	YES	←	NO
String Functions (DEF FNAS(Q$, X$)	YES	←	NO	YES	←	NO

CAPABILITY	16 USERS			32 USERS		
	RSTS-20	WINNER	HP 2000 E	RSTS-45	WINNER	HP 2000 F
V. DATA TYPE						
Real	YES		YES	YES		YES
Integer	YES	←	NO	YES	←	NO
String	YES		YES	YES		YES
Real Matrix	YES		YES	YES		YES
Integer Matrix	YES	←	NO	YES	←	NO
String Matrix	YES	←	NO	YES	←	NO
Double Precision	YES	←	NO	YES	←	NO
VI. PRINT FORMATTING						
Formatting Functions	TAB, POS	←	TAB	TAB, POS	←	TAB
PRINT USING	YES	←	NO	YES		YES
EDP Formatting	Floating Dollar Asterisk Protect Trailing Minus	←	None	Floating Dollar Asterisk Protect Trailing Minus	←	None

CAPABILITY	16 USERS			32 USERS		
	RSTS-20	WINNER	HP 2000 E	RSTS-45	WINNER	HP 2000 F
VII. FILE CAPABILITY						
Standard File Statements (INPUT, PRINT)	YES		YES	YES		YES
Disk Files						
Maximum Size	20 million words	←	6000 words	20 million words	←	8 million words
Serial and Random	YES		YES	YES		YES
# simultaneously open	12	←	4	12	→	16
Created/Releted by program	YES	←	NO	YES	←	No
Magmetic Tape Files						
Accessible to on-line user	YES (DECtape or magtape)	←	NO	YES (DECtape or magtape)	←	NO
Accessible to BASIC program	YES (DECtape or magtape)	←	No	YES (DECtape or magtape)	←	NO
Off-line backup	YES		YES	YES		YES
On-line reading of magtapes prepared by another machine	YES	←	NO	YES	←	NO
On-line preparing of magtapes for use on another machine	YES	←	NO	YES	←	NO
Line Printer Files	YES	←	No	YES		YES
Card Reader Files	YES	←	NO	YES	←	No
High-Speed Paper Tape Files	YES	←	NO	YES	←	NO

CAPABILITY	16 USERS			32 USERS		
	RSTS-20	WINNER	HP 2000 E	RSTS-45	WINNER	HP 2000 F
VIII. ADVANCED LANGUAGE FEATURES						
Multiple Statements Per Line	YES	←	NO	YES	←	NO
UNLESS, WHILE, UNTIL Modifiers	YES	←	NO	YES	←	NO
Multi-line DEF	YES	←	NO	YES		
IX. MONITOR COMMANDS						
Standard Set (HELLO, BYE, NEW, OLD, DELETE, LIST, LISTNH, RUN, RUNNH, SAVE, UNSAVE, RENAME, REPLACE, CATALOG)	YES		YES	YES		YES
Save compiled code	YES	←	NO	YES		YES
ASSIGN, DEASSIGN device	YES (Card reader, line printer, DECtape, magtape, tape reader, tape punch)	←	NO	YES (Card reader, line printer, DECtape, magtape, tape reader, tape punch)	←	YES (Line printer only)